AMATS: Glenn Highway Integrated Corridor Management (ICM) Study

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DRAFT Existing Conditions Report: Part 5 Crash History and Analysis

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DOT&PF

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Table of Contents

Figures

Tables

Abbreviations

AADT	Average Annual Daily Traffic
CAR	Critical Accident Rate
DOT&PF	Alaska Department of Transportation and Public Facilities
HSIP	Highway Safety Improvement Program
KE	Kinney Engineering
MP	Milepoint
PDO	Property Damage Only

Definition of Terms

Average Annual Daily Traffic (AADT): A measurement of the number of vehicles traveling on a segment of highway each day, averaged over the year.

Controlled Access Freeway: Divided multi-lane highway without direct access to adjacent land uses. Users must utilize ramps to reach adjacent highway facilities with access to the adjacent land uses.

Crash Modification Factor (CMF): Factor associated with a safety treatment. Crashes for the condition without the safety treatment are multiplied by the crash modification factor to determine the number of crashes if the treatment is applied. CMFs are determined using a statistical analysis of sites with and without the treatment.

Integrated Corridor Management (ICM): Management of a transportation corridor to optimize use of available infrastructure by directing travelers to underutilized capacity (for example, shifting travel times, routes, or mode). Multijurisdictional partner agencies manage ICM corridors as collaborative, multimodal systems.

Interchange: Set of ramps and intersections used to allow traffic to travel to and from a controlled access freeway facility.

Level of Service (LOS): Performance measure concept used to quantify the operational performance of a facility and present the information to users and operating agencies. The actual performance measure used varies by the type of facility; however, all use a scale of A (best conditions for individual users) to F (worst conditions). Often, LOS C or D in the most congested hours of the day will provide the optimal societal benefits for the required construction and maintenance costs.

Peak Hour Factor (PHF): Measure of traffic variability over an hour period calculated by dividing the hourly flowrate by the peak 15-minute flowrate. PHF values can vary from 0.25 (all traffic for the hour arrives in the same 15-minute period) to 1.00 (traffic is spread evenly throughout the hour).

Critical Accident Rate (CAR): Statistical measure used in crash rate analysis to determine statistical significance. If the crash rate of the location in question is above the upper control limit for that location, the crash rate is above the average crash rate for similar facilities to a statistically significant level.

Volume to Capacity Ratio (v/c): Measure of how much of the available capacity of a facility is being used, calculated by dividing the demand volume by the capacity of a facility. Values of 0.85 or less indicate adequate capacity to serve the demand volume. When v/c is greater than 0.85, drivers begin to feel uncomfortably crowded.

1 Introduction

The Alaska Department of Transportation and Public Facilities (DOT&PF) has retained Kinney Engineering, LLC (KE) to prepare this Crash History and Analysis as part of the Glenn Highway Integrated Corridor Management Study (ICM). The study corridor experiences non-recurring congestion due to unplanned events (such as crashes) and planned events (such as road construction), that require lane closures and have a significant negative impact on the movement of people and goods. The focus of the crash analysis is to perform a brief overview of the crash history to find factors that might contribute to crashes along the corridor, so that mitigations that could reduce the number of crashes can be proposed.

2 Crash Analysis

DOT&PF provided crash data for the approximately 30 miles of the Glenn Highway corridor between Airport Heights (milepoint 0.0) and the end of the Municipality of Anchorage (MOA, milepoint 29.1) for the 10 years between 2005 to 2014. For each crash listed in the DOT&PF database, the crash type and location were reviewed and adjusted using engineering judgement to improve the analysis. Crash data was provided for 4,169 crashes that occurred from 2005 through 2014. Out of these reported crashes, 3,684 crashes were analyzed. Crashes were not considered for analysis if the correct location of the crash could not be determined.

2.1 Corridor Crash Rates

Crash rates were calculated based on the number of crashes, number of years in the study period, and average annual daily traffic (AADT) over the period of study. The Glenn Highway is classified as a freeway, and average crash rates for the corridor were computed from the 1,760 crashes that occurred in the most recent 5-year period with available data (2010-2014). Using the 2017 Highway Safety Improvement Program (HSIP) Handbook and High Accident Location Screening spreadsheet, the crash rates were compared to statewide average crash rates for similar facilities and corresponding time periods as well as to the Critical Accident Rate (CAR). The CAR is a calculated threshold above which the observed rate at a given location is considered statistically higher than average at a 95% confidence level. When a computed crash rate exceeds the CAR, there is strong evidence that the higher than expected number of crashes are not just random occurrences but are caused by underlying contributing factors.

To calculate the crash rates along the study corridor, the Glenn Highway was divided into fifty-eight (58) half-mile segments, starting at milepoint 0.25 and working north (outbound) to the end of the MOA at milepoint 29.1. The signalized intersection of the Glenn Highway at Airport Heights (milepoint 0.0) was not included in the crash analysis because crash rates at signalized intersections differ significantly compared to crash rates for freeway segments. The milepoint and location of each crash was analyzed and adjusted as needed. Milepoints for crashes associated with the southbound lanes were converted to correspond to northbound (outbound) milepoint locations. The crash rate for segments is given in terms of crashes per million vehicle miles traveled (MVMT).

The state average crash rate for rural freeways is 0.9 crashes per MVMT, while the average crash rate for the entire study corridor was calculated to be 0.8 crashes per MVMT. Figure 1 shows the crash rates for each segment and indicates which segments have higher than average crash rates.

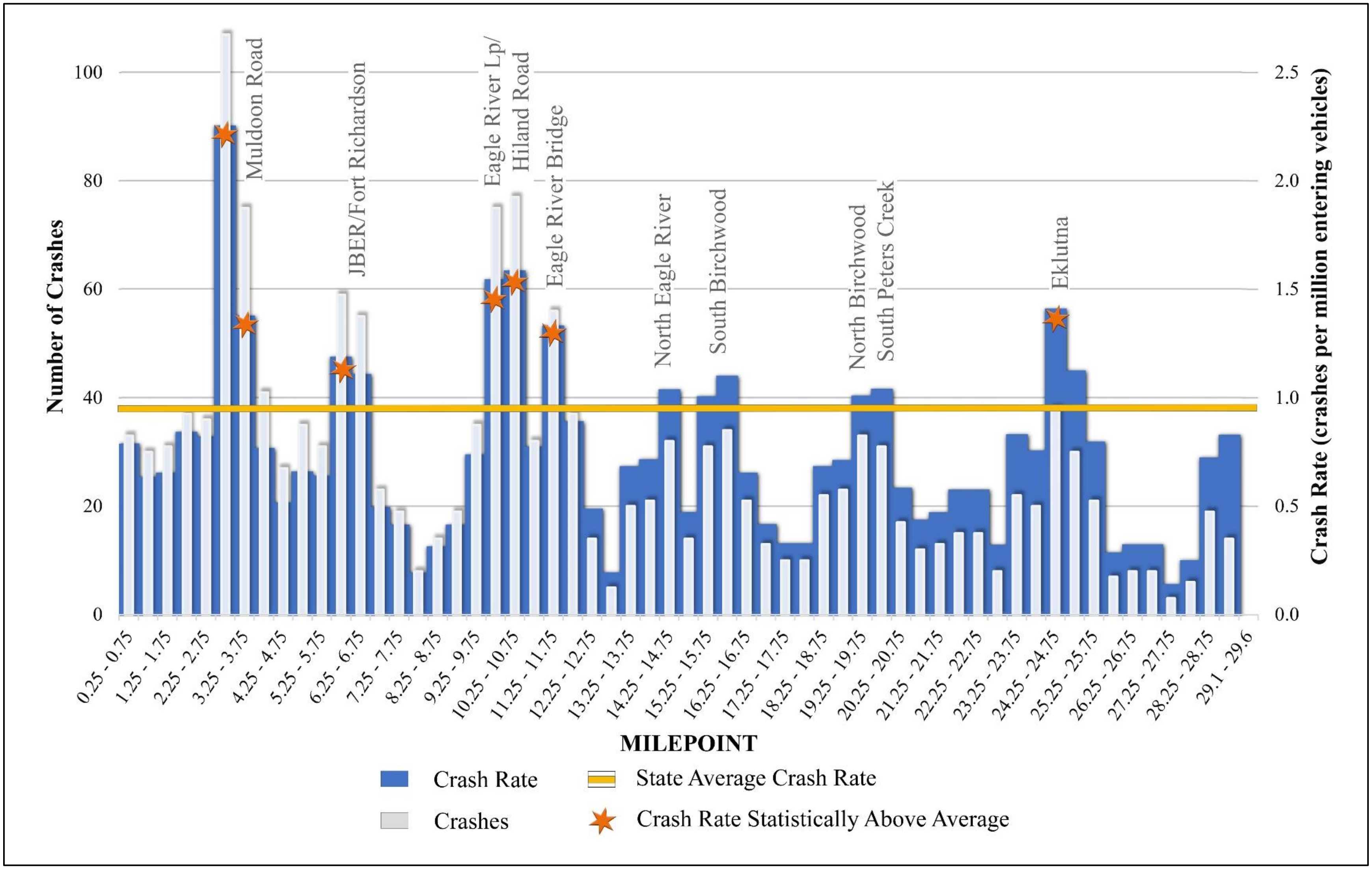

Figure 1: Crashes and Crash Rates by Milepoint (2010 to 2014)

2.2 Crash Types and Severity

Figure 2 shows the type and frequency of crashes that occurred in the study corridor. A quarter of the crashes occurred when a vehicle ran off the road. Rear end crashes accounted for 23% of the crashes, while 20% of the crashes occurred when a vehicle struck an object, either fixed or not fixed.

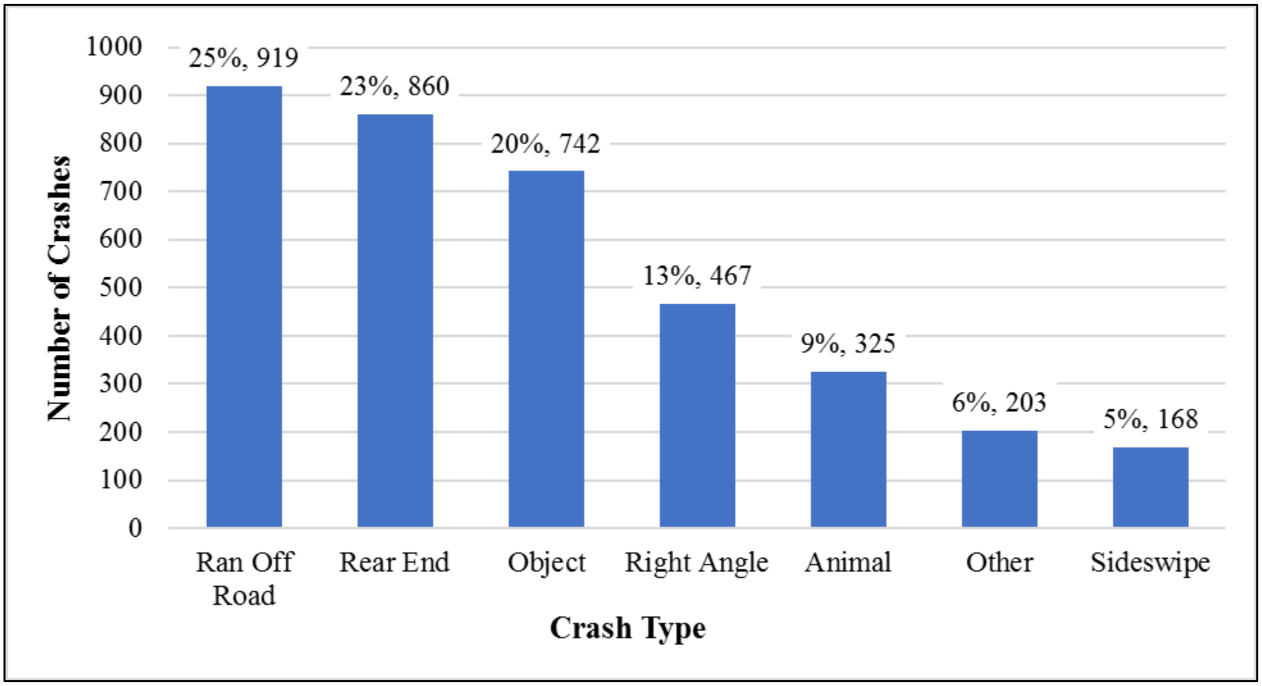

Figure 2: Crash Types on Study Corridor (2005 to 2014)

Figure 3 shows the distribution of crash severity for crashes that occurred in the study area from 2005 to 2014. Eighteen fatal crashes occurred during the study period. Figure 4 shows the monthly distribution of crashes, categorized by severity. Note that the number of fatal and major injury crashes are roughly the same each month throughout the year, while the number of minor injury and property damage only crashes are higher during winter months and lower during the summer months.

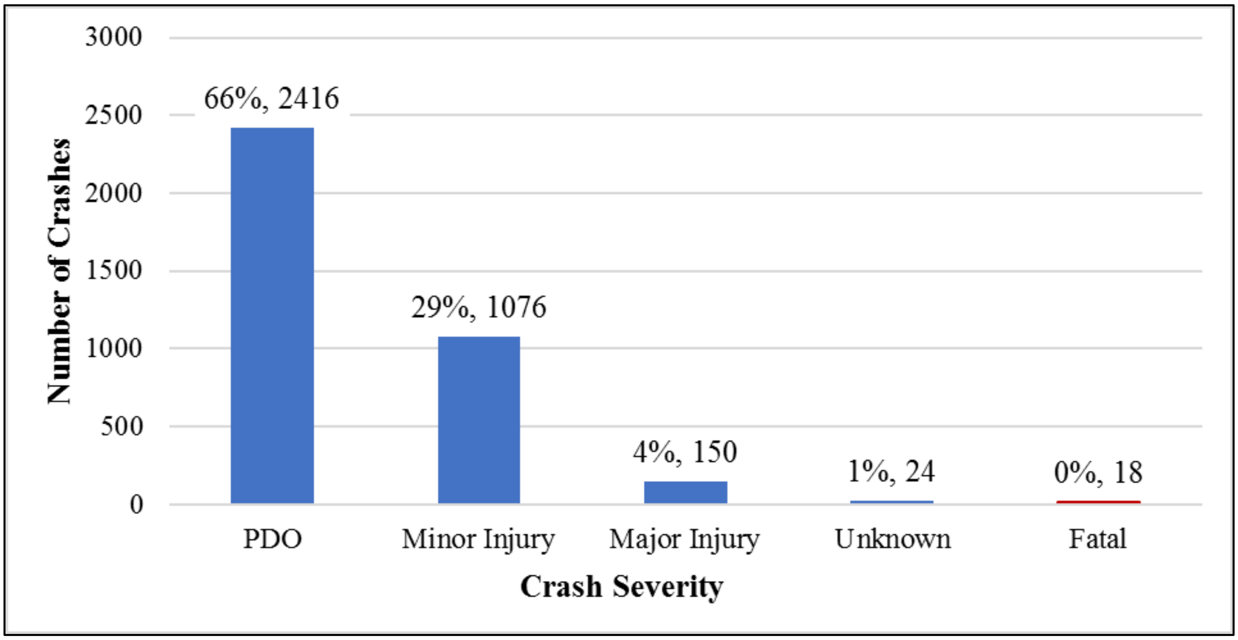

Figure 3: Crash Severity

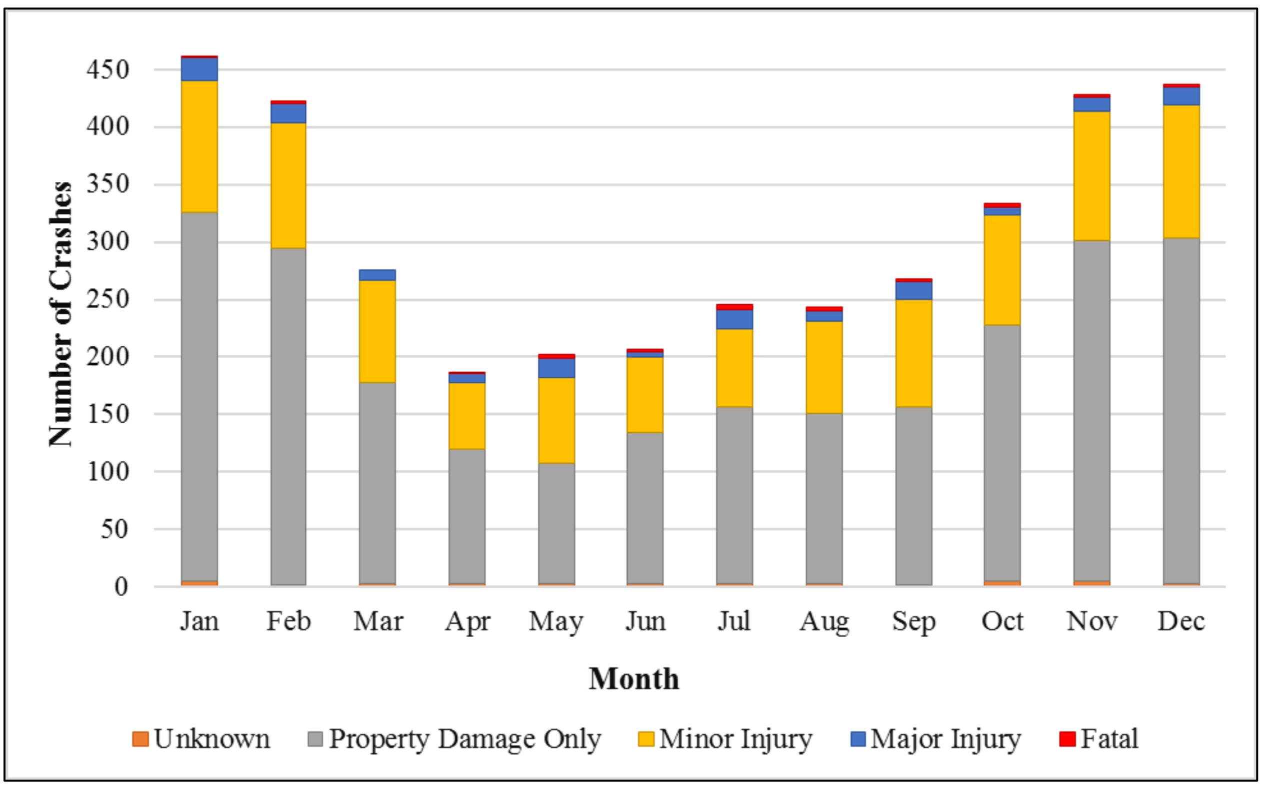

Figure 4: Monthly Distribution of Crashes by Severity

2.2.1 Fatal Crashes

When a fatal crash occurs, police must collect additional data, resulting in longer road closures. Eighteen fatal crashes occurred between 2005 and 2014. The crashes were generally spread throughout the study corridor, as shown in Table 1. However, three of the eighteen crashes occurred at the North Birchwood interchange.

Table 1: Fatal Crash Locations

Location	Number of Crashes	MP	Year
Airport Heights/ Mountain View Drive	1	0.1	2010
Bragaw Street	1	0.7	2008
Boniface Parkway	1	1.5	2009
Turpin Street	1	2.3	2007
Muldoon Road	1	2.9	2013
Fort Richardson/Arctic Valley	1	6.1	2009
S Curves/Scales	1	8.9	2013
Eagle River Loop/Hiland Road	1	10.0	2011
Eagle River Bridge	1	11.2	2005
N. Eagle River	1	14.1	2010
S. Birchwood	1	16.8	2011
N. Birchwood	3	18.3	2010
		19.3	2009
		19.5	2009
Mirror Lake	1	22.7	2007
Thunderbird Falls	1	24.1	2006
Eklutna Flats	1	26.3	2014
Old Glenn Highway	1	27.4	2007

Figure 5 shows the crash types for the fatal crashes that occurred on the study corridor.

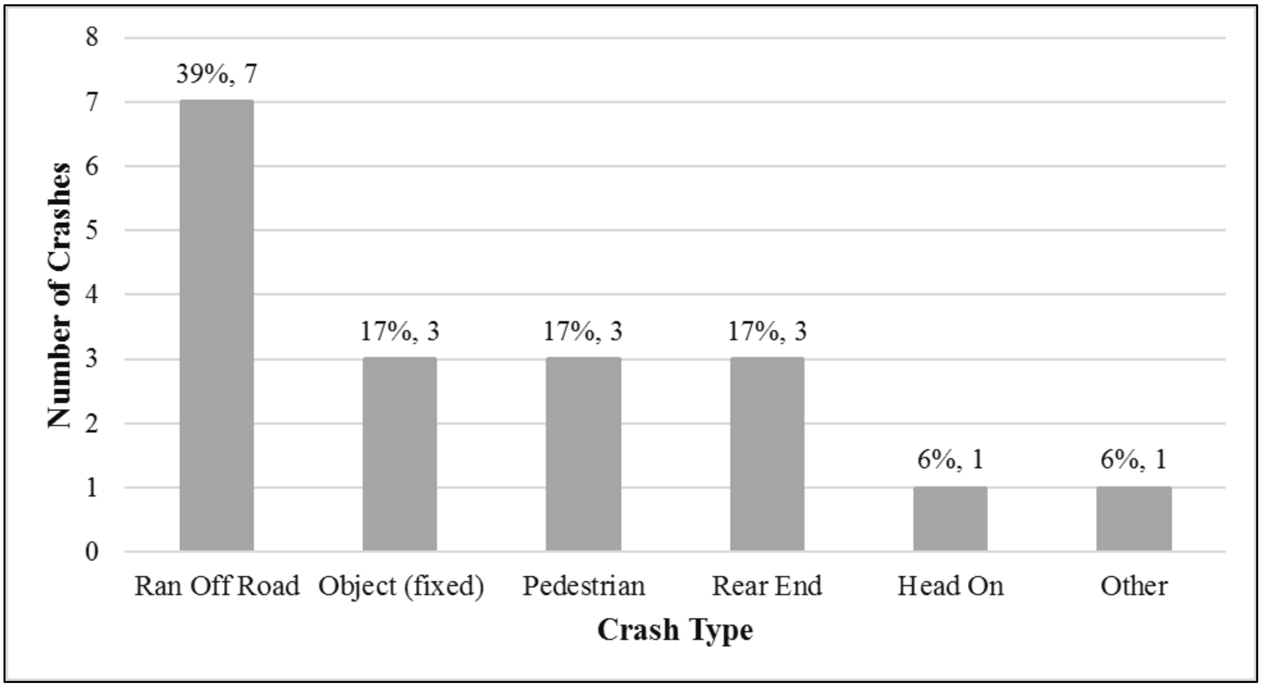

Figure 5: Fatal Crash Types

2.3 High Crash Days (> 10 Crashes/Day) Within the Study Corridor

On days with a higher than usual number of crashes, it likely takes responders longer to respond to crashes and clear the highway. Longer response times likely result in increased delay on the study corridor, making days with a high occurrence of crashes of interest to this study. Crash days on which 10 or more crashes occurred in the study corridor are listed in Table 2 along with general crash locations. Out of the 24 days with more than 10 crashes between 2005 and 2011, all fell within the 8-month period from October through May, with the highest number of days with greater than 10 crashes occurring in January (5 days) and February (7 days). About one-third of the crashes on high-crash days occurred in the Anchorage Bowl (MP 0 to 5). Another third occurred in the combined Eagle River-Birchwood area (MP 10 to 20). About 20% of the crashes on high-crash days occurred in the area where the highway passes through JBER (MP 5 to 10).

Table 2: Days with More than Ten Crashes in the Study Corridor

Year	Date	Number of Crashes	MP 0 - 5	MP>5-10	MP>10-15	MP>15-20	MP>20-25	MP>25-30
2005	December 23	11	6	1	2	2	-	-
2006	January 19	11	-	-	7	4	-	-
	February 1	15	9	1	4	-	1	-
	February 10	10	2	2	2	4	-	-
	February 25	12	9	1	2	-	-	-
2007	November 10	9	1	1	-	-	5	2
2008	April 9	11	4	-	3	4	-	-
	October 13	10	1	1	2	5	-	1
	December 10	13	5	5	1	1	1	-
2009	January 9	10	2	2	-	-	6	-
	January 14	13	8	2	3	-	-	-
	January 30	11	2	3	1	4	1	-
	February 28	28	6	10	-	11	-	1
	November 11	10	4	5	-	-	1	-
	December 14	12	4	7	-	-	1	-
2010	February 6	14	3	7	3	-	-	1
2012	January 8	11	5	5	1	-	-	-
	February 21	15	5	-	4	1	5	-
	March 14	10	8	2	-	-	-	-
2013	April 6	11	2	2	2	4	-	1
	May 18	11	1	1	4	2	1	2
	November 9	10	9	1	-	-	-	-
2014	March 5	12	3	2	-	4	2	1
	October 25	11	-	-	5	4	-	2
TOTAL		291	99 (34%)	61 (21%)	46 (16%)	50 (17%)	24 (8%)	11 (4%)

2.4 Crash Contributing Factors

2.4.1 Traffic Volumes

Historical traffic volume data for the crash analysis period (2005 – 2014) was collected from the DOT *Central Region Annual Traffic Volume Reports*. Crashes in the study corridor were not found to follow yearly traffic volume trends, as shown in Figure 6. A comparison between monthly traffic volumes and monthly crash periods showed that the number of crashes increases during winter months while traffic volumes decrease in these months, as depicted in Figure 7.

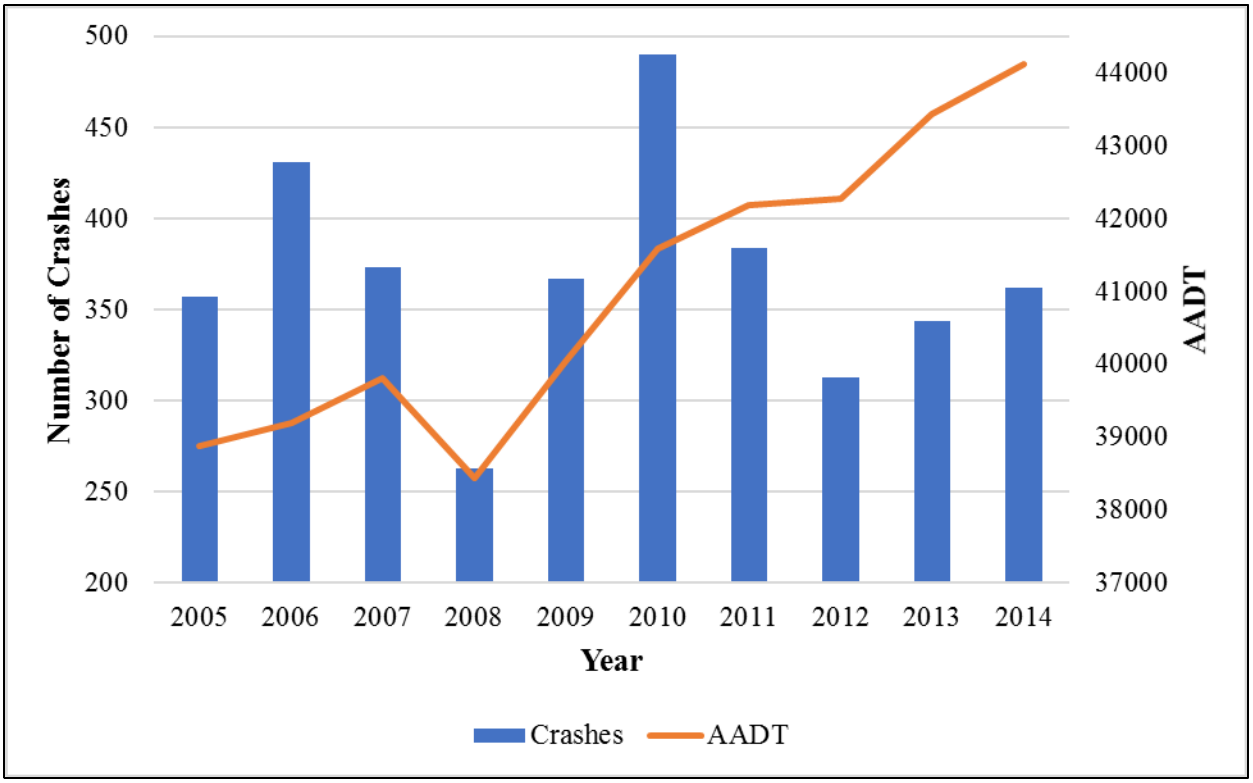

Figure 6: Crash Frequency Compared to AADT

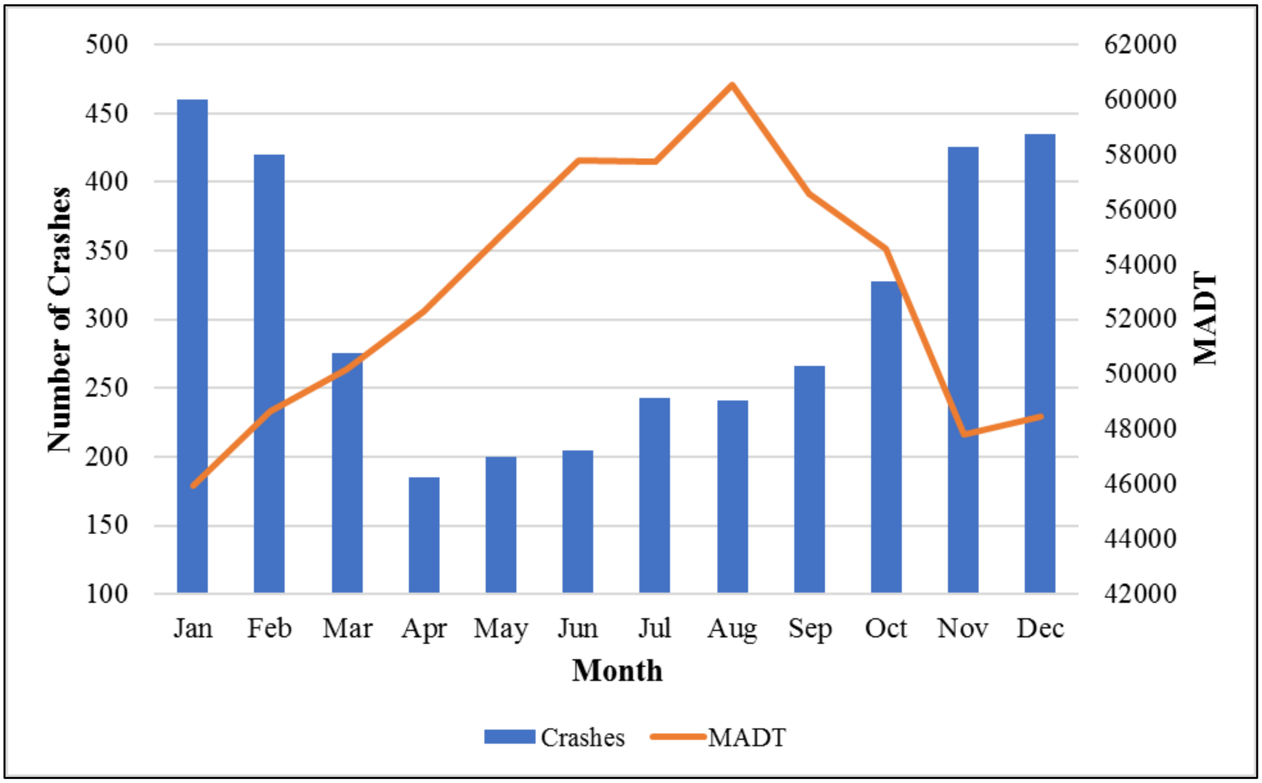

Figure 7: Crash Frequency Compared to MADT

2.4.2 Weather

The higher occurrence of crashes in winter suggests that winter weather and road conditions may contribute to the occurrence and frequency of crashes on the study corridor.

Table 3 provides a breakdown of the number and percentage of crashes that occurred in "summer" versus "winter" months for the crash analysis period. On average, 37% of crashes occurred during summer months (April, May, June, July, August, September) and 63% of crashes occurred in winter (October, November, December, January, February, March).

Table 3: Number and Percentage of Crashes, Summer vs. Winter

Crashes/Crash Percentage	Year									
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Summer Crashes	139	106	112	157	157	166	114	103	154	132
Winter Crashes	292	267	151	210	333	218	199	241	203	230
Total Crashes	431	373	263	367	490	384	313	344	357	362
% Summer Crashes	32%	28%	43%	43%	32%	43%	36%	30%	43%	36%
% Winter Crashes	68%	72%	57%	57%	68%	57%	64%	70%	57%	64%

DOT&PF provided weather records from the various weather stations along the Glenn Highway; however, in many cases the weather records were incomplete. Instead, weather records for Anchorage (Ted Stevens International Airport), which are available from the NOAA website, were used to gain insight into how weather may contribute to crashes. Figure 8 compares crashes along the corridor to average monthly precipitation and snowfall over the 10-year crash analysis period (2005 – 2014). Crashes during winter months do increase as snowfall increases, and crashes during summer months follow the summer precipitation curve, suggesting that the occurrence and frequency of crashes is correlated to weather conditions.

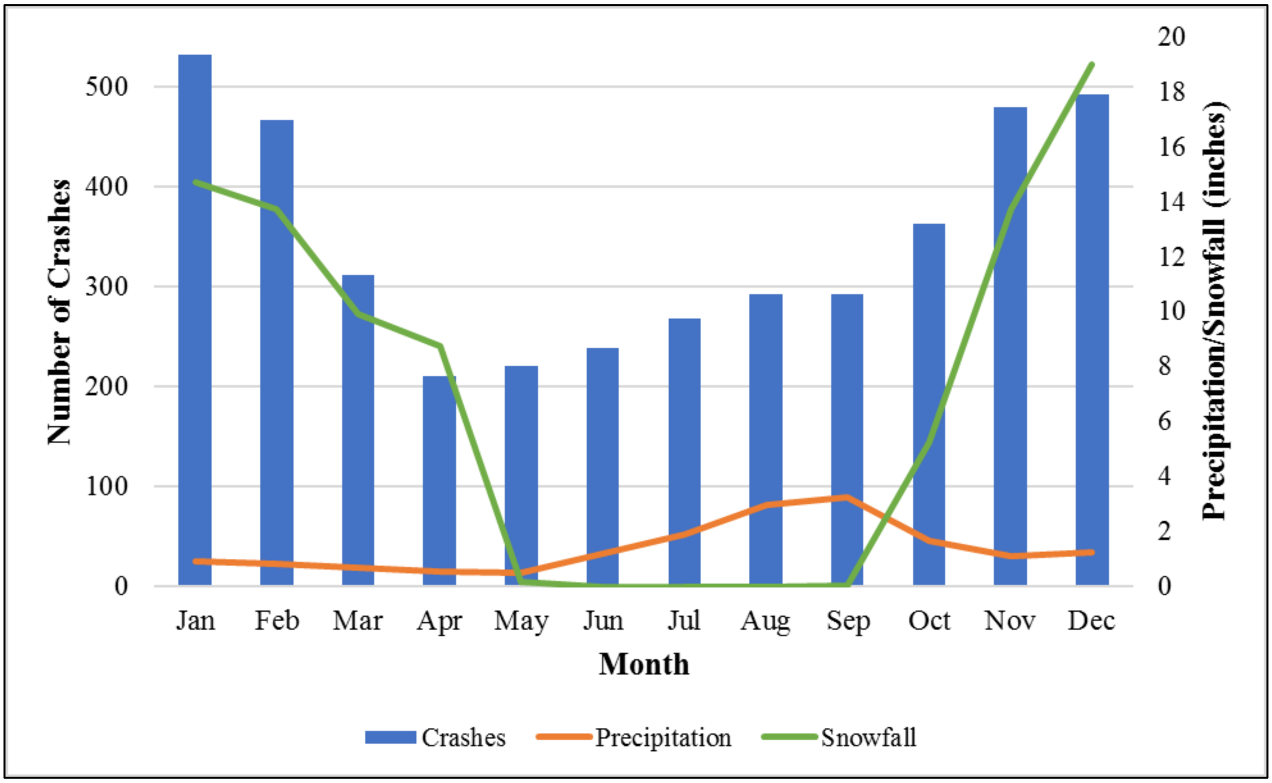

Figure 8: Crashes Compared to Snowfall

Days on which more than 10 crashes occurred were compared to NOAA weather data to determine any correlation between adverse weather and the high occurrence of crashes as depicted in Table 4. Snowfall over 1 inch was recorded on 64% (16 out of 25) of the high crash days. The remaining days saw little to no snow. However, several of the days with little to no snow were preceded by days with very heavy snow (marked with asterisk in Table 4). While it is likely that heavy snow does correspond to an increase in crashes, it is clearly not the only factor. This is further evidenced by heavy snow days which had no or few recorded crashes.

Table 4: Days with Greater than 10 Crashes Compared to Precipitation and Snowfall

Year	Date	Number of Crashes	Precipitation (inches)	Snowfall (inches)
2005	December 23	11	0.28	4.8
2006	January 19	11	T	0.8
	February 1	15	0.11	2.9
	February 10	10	0.08	0.4
	February 25	12	0.18	3.4
2007	November 10	9	0.12	1
2008	April 9	11	0.17	3.2
	October 13	10	0.04	1.7
	December 10	13	0.03	0.5*
2009	January 9	10	0.01	0
	January 14	13	0.21	T*
	January 30	11	0.1	4.4
	February 28	28	0.2	7.6
	November 11	10	0.09	1.3
	December 14	12	0.04	0.8
2010	February 6	14	0.13	2.1
2012	January 8	11	0.25	5.9
	February 21	15	0.08	2
	March 14	10	0.15	2.6
2013	April 6	11	0.21	6.2
	May 18	11	0.02	0.1
	November 9	10	0.06	0.2
2014	March 5	12	0.06	2.4
	October 25	11	0	0

T = trace
* = days preceded by days with heavy snowfall

Pavement surface and air temperature data was provided by the DOT&PF. Consideration was made to determine if days/time periods with large recorded differences between pavement temperature and air temperature or with temperatures close to 32 degrees Fahrenheit were correlated to days and times with a high number of crashes. No clear correlation was discovered.

2.5 Summary of Crash Analysis

A brief crash analysis of the study area was completed to gain insight into factors that seem to contribute to increased delay on the Glenn Highway.

- Locations with a higher than expected crash rate seem to be concentrated around some interchanges. A more detailed analysis could identify specific attributes of these interchanges that may be contributing to an increased number of crashes.
- Between 2005 and 2014, there were 18 fatal crashes in the study area. Fatal crashes occur throughout the study area, and do not appear to be concentrated at any specific location. Around 40% of the fatal crashes were related to vehicles running off of the road.
- Between 2005 and 2014, there were 24 days with more than 10 crashes on the study corridor. All 24 of the days were in the months from October through May, with half of them occurring in January and February. On the days with greater than 10 crashes, the crashes appear to be focused in the Anchorage Bowl and in the Eagle River/Birchwood area.
- Weather appears to have a significant impact on the number of crashes, with more crashes occurring in months with more snow. Rain also appears to impact the number of crashes, with more crashes occurring in months with more rain.